

Tandberg LTO HH

**Tandberg LTO-1 HH, LTO-2 HH, LTO-3 HH
(220LTO, 420LTO, 820LTO)
Half Height Tape Drives**

INSTALLATION AND USER MANUAL



TANDBERG DATA ASA

www.tandbergdata.com

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Change log

Date	Author	Chapter	Change
22-Aug-05	WAJo	3.10	Added termination to the internal drive
16-Feb-06	WAJo	All	Added the Tandberg LTO-1 HH tape drive and TDkit. Minor corrections
17-Aug-07	WAJo	All	Added in LTO-3HH (820LTO) and using Tandberg LTO HH where all three products are covered.

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Every effort has been made to avoid errors in text and diagrams. However, Tandberg Data ASA assumes no responsibility for any errors, which may appear in this publication.

It is the policy of Tandberg Data ASA to improve products as new techniques and components become available. Tandberg Data ASA therefore reserves the right to change specifications at any time.

We would appreciate any comments on this publication.

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1. Introduction

Congratulations on your new Tandberg LTO HH tape storage solution!

Tandberg Data ASA is a leading global supplier of advanced, tape-based information data storage products for the professional market. The company offers a wide range of products and solutions for data protection and other user applications within data storage management.

Tandberg Data supplies tape drives and tape storage solutions to the world's leading OEMs and through a worldwide channel sales network.

Total customer satisfaction is of the most importance to Tandberg Data. We guarantee that this product left our premises defect free. If you are not satisfied with the quality of this product, please contact your distributor, dealer or the nearest Tandberg Data office to have your problem resolved quickly.

If you need technical support or have any problem with your LTO HH tape storage solution, phone, fax and addresses can be found under www.tandbergdata.com SUPPORT.

On the following pages, before the installation guide starts, there is some brief information about the Tandberg LTO HH tape storage solutions. Also listed is what is included with the Tandberg Data product you have purchased.

All documentation referred to in this document is available as a downloadable PDF file from the Tandberg Data web site:

www.tandbergdata.com

1.1 Introduction to Tandberg LTO HH (Half Height) Series of Products

Tandberg Data now offers a whole range of LTO tape and automation storage solutions from 200 GB to 64 TB capacity and 115 GB/hr up to 864 GB/hr all assuming 2:1 data compressing. Please visit www.tandbergdata.com for the complete offerings and for more details.

The LTO HH product range consists of:

- LTO-1 HH (220LTO): 200 GB, 115 GB/hr
- LTO-2 HH (420LTO): 400 GB, 173 GB/hr
- LTO-3 HH (820LTO): 800 GB, 216 GB/hr

Designed for the SMB sector, Tandberg's LTO HH products are the ideal synthesis of efficiency, modern innovation and maximum price/performance ratio. LTO's 6 generation roadmap, with 4 generations available today, makes it a clear choice for budget constrained small to medium businesses. Choose a technology with future and guaranteed trouble-free data storage.

1.2 Features and Benefits

- Up to 800 GB capacity and 216 GB per hour transfer rate.
- Ultra160 SCSI interface provides ultimate performance of the SCSI bus
- The LTO tape drives are backward compatible with all older LTO formats. Coupled with the LTO roadmap, this provides the best investment protection
- Tandberg LTO-1 HH is a very affordable entry into the open standard LTO technology offered by four manufacturers.
- Embedded quality monitoring and test features provide preventive maintenance information for reduced down time.

- Low heat dissipation, small half-height 5.25-inch form factor with several mounting capabilities for easy and trouble free integration into servers and workstations

1.3 How to Contact Tandberg Data Technical Support

If you need technical support or have any problem with your LTO-1 HH or LTO-2 HH tape storage solution, phone, fax and addresses can be found under www.tandbergdata.com SUPPORT.

2 Specifications

2.1 Tape Drive Capacity and Performance

Tape Drive Model	Tape Format	Capacity ¹⁾	Sustained Transfer Rate ¹⁾	Interface Type
Tandberg LTO-3 HH	Ultrium Gen. 3	400/800GB	30/60 MByte/sec	Ultra160
	Ultrium Gen. 2	200/400GB	24/48 MByte/sec	Ultra160
	Ultrium Gen. 1	100/200 GB	16/32 MByte/sec	Ultra160
Tandberg LTO-2 HH	Ultrium Gen. 2	200/400 GB	24/48 Mbyte/sec	Ultra160
	Ultrium Gen. 1	100/200 GB	16/32 MByte/sec	Ultra160
Tandberg LTO-1 HH	Ultrium Gen. 1	100/200 GB	16/32 MByte/sec	Ultra 160

1) Capacity and transfer rate given in native/compressed (assuming 2:1 compression)

2.2 Media Specifications and Compatibility

Drive Model	Media Name	Tape Length	Capacity (Native)	Ordering no.
Tandberg LTO-3 HH	LTO Ultrium Generation 3 (Native format)	680 m	400 GByte	43 32 16
	LTO Ultrium Generation 2 (Read/Write compatible)	609 m	200 GByte	43 27 44
	LTO Ultrium Generation 1 (Read compatible)	609 m	100 GByte	43 26 30
Tandberg LTO-2 HH	LTO Ultrium Generation 2 (Native format)	609 m	200 GByte	43 27 44
	LTO Ultrium Generation 1 (Read/Write compatible)	609 m	100 GByte	43 26 30
Tandberg LTO-1 HH	LTO Ultrium Generation 1 (Native format)	609 m	100 GByte	43 26 30

2.3 Mechanical Dimensions

Standard drive mounting:

Fits in a 5.25-inch half-height (“slim-line”) enclosure for diskette, CD/DVD-rom or disk drive. Standard mounting holes as for a half-height drive.

Dimensions (max.):

Height/width/depth: 41.3/146.0/214 mm (1.625/5.75/8.4 inch)

2.4 Power Requirements

Tandberg LTO-1, LTO-2, LTO-3 in external tabletop enclosure:

AC Input: 100 VAC / 0.6 A or 240 VAC / 0.3 A, 50-60 Hz

Tandberg LTO as standalone:	LTO-1/LTO-2	LTO-3
DC Input (typical operation) 5 VDC	2.1 A	0.8 A
DC Input (typical operation) 12 VDC	0.6 A	0.7 A

2.5 Heat Dissipation

Tandberg LTO as standalone:	LTO-1/LTO-2	LTO-3
Operating:	18 W	13 W
Sleep mode with cartridge inserted:	9 W	6 W

2.6 Data Compression

Data Compression is a way to increase capacity on a storage device. Compression ratios are normally specified to be 2:1, meaning that it is possible to store twice as much data on the tape as without data compression. However, the compression rate is depending on the type of data, e.g. ordinary text files can be compressed in a much higher rate than program- and picture files.

There are two ways to compress data, hardware compression and software compression. Hardware compression means that the data compression is done by the electronics in the storage device. Software compression means that an application program in the host computer is compressing the data before it is sent to the storage device. Hardware compression is much more efficient, and works much faster than software compression.

The Tandberg LTO HH tape drives uses SLDC hardware compression to compress data. This feature is enabled per default but the user may turn off data compression through the application software.

Note:

If the data are compressed by software in the host computer, and then sent to a device that does hardware compression, the data have a tendency to expand instead of being compressed.

Be sure to turn the software data compression off if using the Tandberg LTO HH - which has embedded hardware compression.

3 Tape Drive Installation

3.1 Solution Contents

Note:

Please Check the Package Contents before Beginning the Installation and please check the label on packing box for the actual content.

For Bare Drive:

- Internal Tandberg LTO HH tape drive
- Quick Installation Guide
- Warranty card

For the Internal Kit and Solution:

- Internal Tandberg LTO HH or LTO-3 HH tape drive
- Internal SCSI cable
- Removable LVD/SE terminator
- Data cartridge (1 or 5 depending on type of kit/solution)
- Application software (optional)
- Quick Installation Guide
- Warranty card

For the External Tabletop Kit and Solution:

- Tabletop Tandberg LTO-1 HH or LTO-2 HH tape drive with power cord
- External SCSI cable
- External LVD/SE SCSI terminator
- Data cartridge (1 or 5 depending on type of kit/solution)
- Application software (optional)
- Quick Installation Guide
- Warranty card

3.2 Tape Backup Software Installation

You will need to install tape backup application software that supports the Tandberg LTO HH tape drive. For the latest supported software version, please go to www.tandbergdata.com and select SUPPORT, the actual LTO tape drive and select Compatibilities – or to the backup application software vendor's Web site.

For installation of tape backup application software, please refer to the software vendor's installation guide. Please also see section 5 in this document for installation of backup features embedded in the operating systems.

3.3 Installation of Software Device Drivers

If the backup application software does not detect the tape drive, or obtain the latest operating system drivers and upgrades, please visit www.tandbergdata.com.

3.4 Mechanical Installation Internal Tape Drive

For mechanical mounting specifications, see Figure 3.2.

Allowed mounting position is either horizontal with the indicator LEDs to the right, or vertical with the indicator LEDs up (see Figure 3.1).



Figure 3.1 Allowed mounting orientations

The drive occupies a half-height 5.25-inch slot with mounting screws on both sides of the drive chassis or at the bottom of the drive.

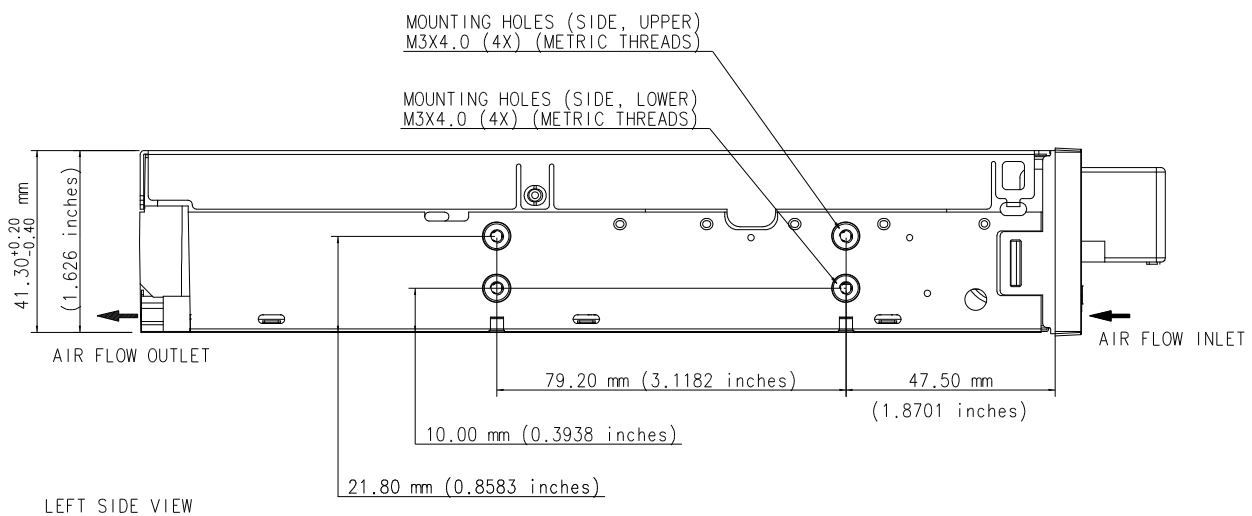
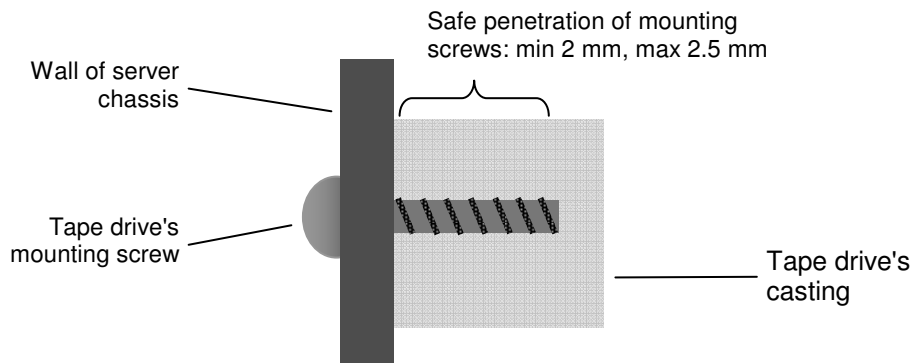


Figure 3.2 Mounting specifications

3.5 Mounting Screw Requirements

- Only M3 (metric) screws must be used for mounting the drive
- Maximum permitted screw penetration: 2.5 mm
- Minimum required screw penetration: 2.0 mm
- Screw torque, mounting screws: 0.5 Nm
- Screws are supplied with all the Tandberg LTO HH drive variants
- Bag with 4 screws and 4 SCSI-ID jumpers (Ordering no. 43 32 65)

***Do not use longer screws or higher screw torque than specified!
Longer screws will bottom and not fasten the drive!***



Maximum Screw Penetration by Mounting Hole Location

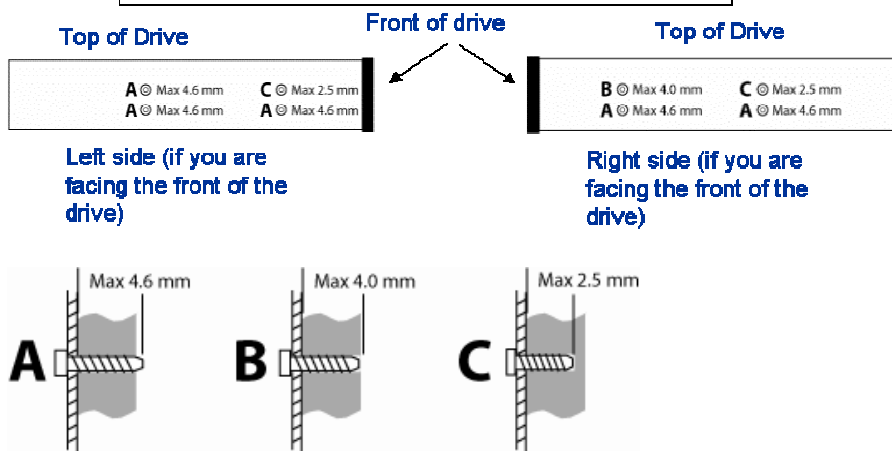


Figure 3.3 Mounting screw details

3.6 SCSI Bus Interface

The Tandberg LTO HH tape drive is designed to operate on an Ultra160 low voltage differential SCSI bus (LVD) with a burst transfer rate up to 160 MB/sec. The Ultra160 SCSI interface is backward compatible with older SCSI interfaces. Thus all Ultra Wide may be used.

The tape drive features a high density 68-pin (HD-68) connector for attachment to the server or to the interface connector in an external tabletop cabinet.

Attachment to the host computer is described below.

3.7 SCSI Controller Board Installation

Note:

Before any SCSI device can be installed it is necessary to have a SCSI controller board installed. Please pay attention to the following points.

- Make sure your computer is turn off before proceeding to the installation.
- If you computer is equipped with an onboard SCSI controller, before proceeding with the installation, you must first locate the SCSI connector on the computer motherboard.

- Refer to the documentation provided with your computer to find out where this connector is located.
- If multiple SCSI connectors are available, you can choose any of them, except if your computer documentation mentions something different.
- When done, firmly connect the SCSI connector to the Main-board connector and refer to section 3.8 SCSI Configuration and 3.9 SCSI-bus Termination.
- If your PC/Server needs a separate SCSI controller, you need to make sure it is properly installed before connecting your Tandberg LTO HH tape drive.
- You will also need a software driver from the SCSI controller vendor to activate the SCSI Controller. Please make sure you have the latest software driver for your SCSI controller loaded, and that the SCSI controller board is properly installed. Software drivers can be downloaded from the vendors' web site. Refer to the README file for installation.
- Please refer to the PC/Server documentation for further information on how to install additional boards in the PC/Server. Or ask your local dealer for assistance.

3.8 SCSI Configuration

All devices on a SCSI-bus need their own unique identification, called SCSI-ID. If a SCSI-ID conflict exists, some of the SCSI devices will not be recognized by your system. In many systems it is common to use the SCSI-bus for the hard-drive and CD-ROM, as well as the tape drive. Remember that the SCSI Controller uses SCSI-ID 7.

3.8.1 SCSI-ID Selection Tandberg LTO HH Internal Tape Drive

The SCSI-ID on the Tandberg LTO HH is set by jumpers. From the table below, you can “read out” which SCSI-ID the device has been set up for. All SCSI device ID's are displayed on the screen during system startup.

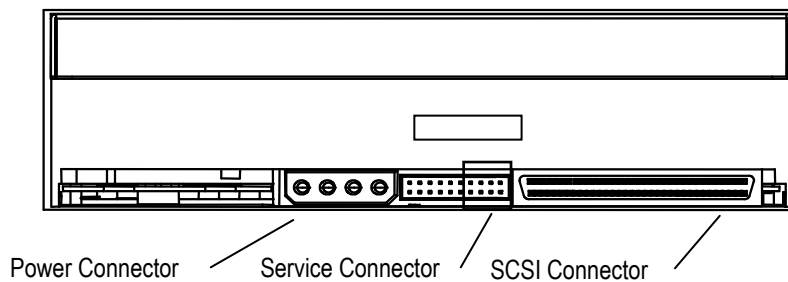


Figure 3.4 Drive connectors, internal model

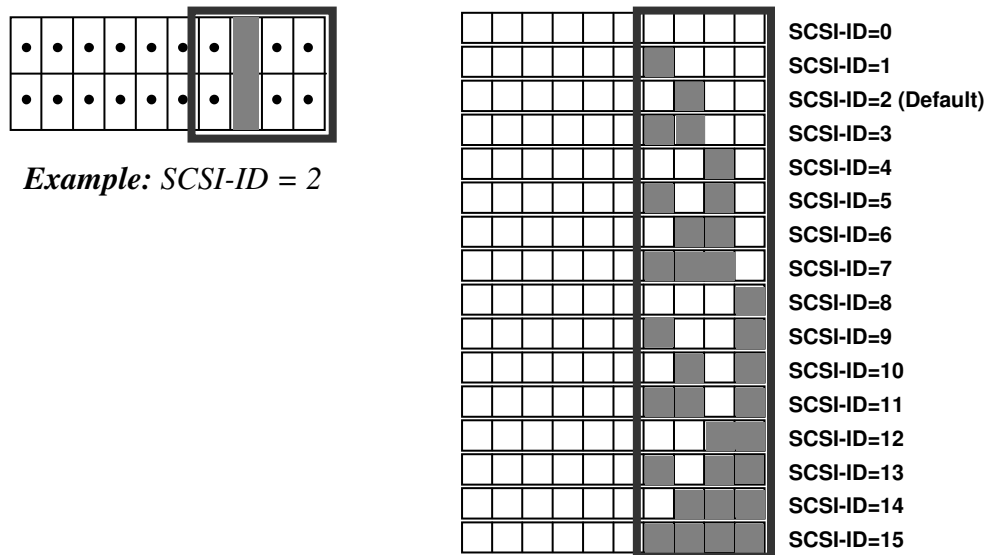


Table 3.1 Service Connector strap settings for SCSI-ID (Dark = Strap mounted)

If the tape drive is the only device on the SCSI bus, you do not need to do anything.

The tape drive will be recognized automatically. (All Tandberg Data tape drives are delivered with SCSI-ID 2 as default.)

If the tape drive is going to share the SCSI-bus with other devices, check the SCSI-ID numbers used by the other devices, then set the drive’s SCSI-ID to a number that is not being used by any of the other devices (remember the SCSI host adapter uses ID 7)

3.8.2 SCSI-ID Selection Tandberg LTO HH External Tape Drive

For the external tabletops, you will find the SCSI-ID setting thumb-wheel switch on the rear end of the unit box:

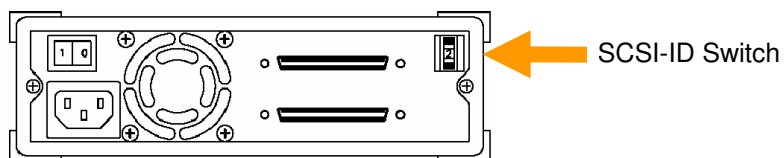


Figure 3.5 Drive connectors, external tabletop model

3.9 SCSI-bus Termination

3.9.1 Termination in General

A SCSI-bus is susceptible to interference, such as noise from electrical motors and other electromagnetic devices. Also due to the speed of the data on the SCSI-bus, it is of outmost importance to terminate the SCSI-bus properly. “Termination” is used to define the ends of the SCSI-bus.

3.9.2 SCSI-bus Termination – Internal Tape Drives

The SCSI-bus cable must be terminated in both ends according to SCSI specifications. If the tape drive is the last device on the bus, the bus must be terminated within 10 cm of the tape drive connection.

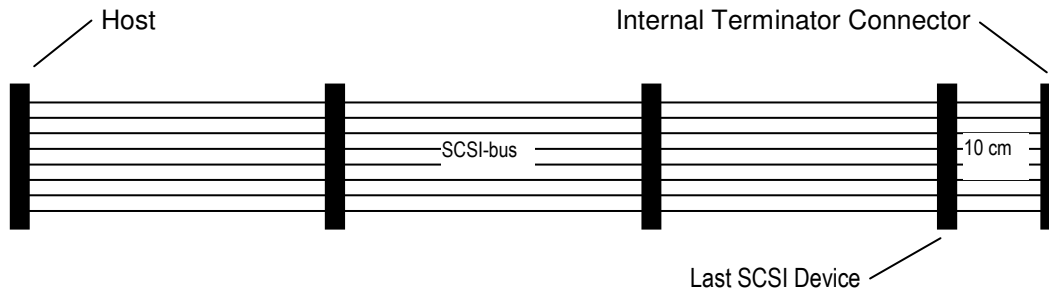


Figure 3.6 Internal SCSI cable

Tandberg LTO HH tape drives have a combined SCSI-LVD/SE interface embedded. The PC-98 Specification specifies that the termination of the SCSI-bus system is a part of the SCSI-cable and not a part of the SCSI-device.

For internal devices, a SCSI-cable with an integrated terminator or a separate terminator applied to the end connector of the cable, 10 cm from the last device must be used.

3.9.3 SCSI-bus Termination – External Tape Drives

If the Tape drive is the only device on the external SCSI-bus, it must be terminated using the external SCSI termination provided with the solution.

If other external device(s) is/are present, the Tandberg LTO HH tape drives can be installed in any position on the SCSI-bus. The Tandberg LTO HH tapes drive must be terminated if installed at the end of the SCSI-bus. See figure 3.7:

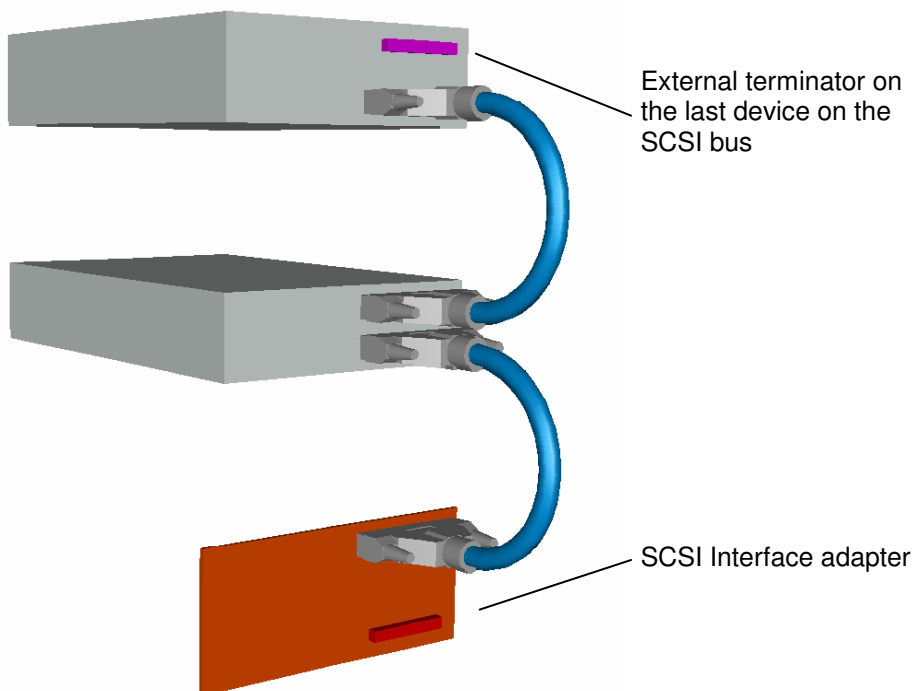


Figure 3.7 Termination of external SCSI devices

3.10 Installation Internal Tape Drive

Internal installation of the drive requires a free 5.25-inch half-height bay with an open front in your computer system.

1. Obtain access to the removable media bay. (Refer to the documentation supplied with your server for more information on accessing the removable media bay.)
2. Slide the tape drive into the bay, as shown in Figure 3.8.

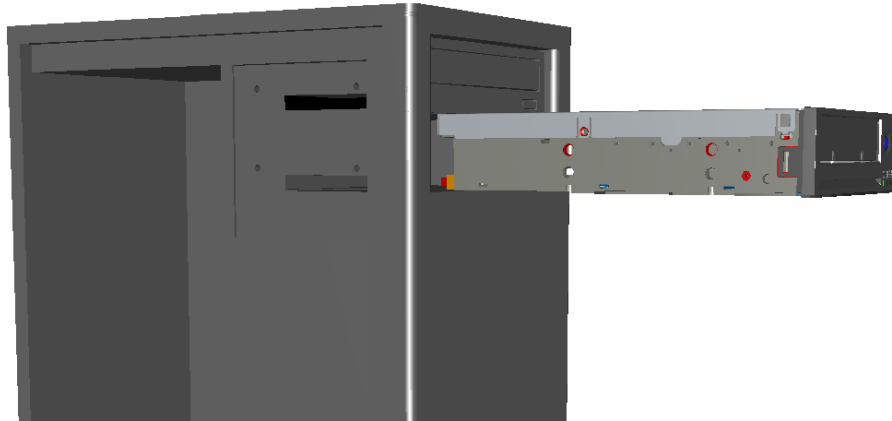


Figure 3.8 Installing the internal tape drive

3. Secure the tape drive to the bay. (If screws are required, use the screws supplied with the tape drive, or equivalent. See Section 3.4 Mechanical Installation and Section [3.5 Mounting Screw Requirements](#).)
4. Connect the power cable and the SCSI signal cable, as shown in Figure 3.9.

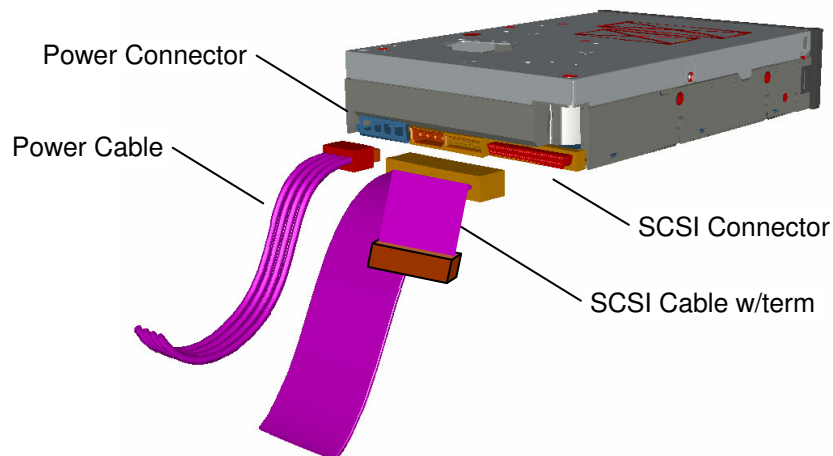


Figure 3.9 Connecting the cables to the Tandberg LTO HH tape drive

3.11 External Tape Drive Installation

After the SCSI controller board has been installed and is working properly, the tape drive can be installed. Before starting, make sure the power is turned off.

Please read carefully the Information about the SCSI-ID conflicts and SCSI termination in Sections [3.8](#) and [3.9](#).

Note: Do not apply or insert power cord until all connections have been made.

To install a tabletop tape drive, simply:

1. Connect the tape drive to your PC/Server with the enclosed SCSI cable to any of the two available SCSI connectors. Remember to place the termination on the free connector on the back of the tape drive, and to select a unique SCSI-ID.

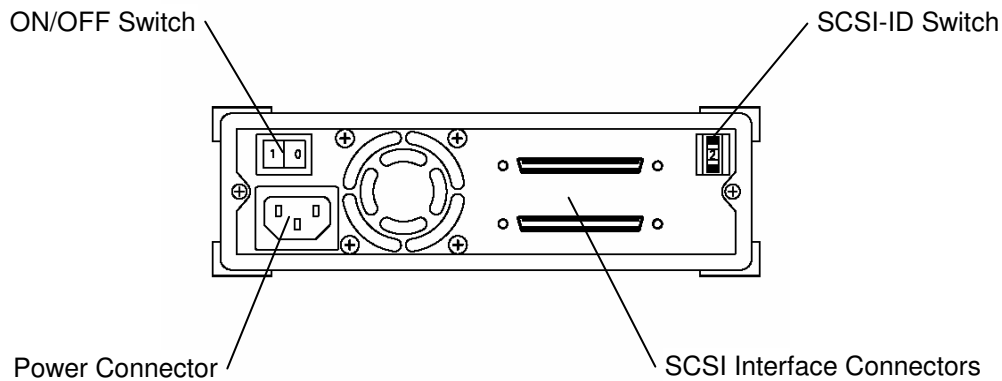


Figure 3.10 Connecting the external Tandberg LTO HH tape drive

2. Connect it to the power outlet.
3. When you power up the system for the first time, check that all your SCSI devices are recognized by the SCSI controller board.

3.12 Verifying Tape Drive Operation

Once you have installed the Tandberg LTO HH tape drive hardware to the host computer, verify that it is functioning properly before you attempt to store data.

1. **For internal drives:** Switch on the host computer
2. **For external drives:** Switch on the drive before switching on the host computer
3. The Tandberg LTO HH tape drive starts a power-on selftest exercising most of the drive's functionality without requiring any cartridge to be inserted.
4. All the four LEDs light during power-up (see section [4.1 Front LED Indicators](#)).
5. The Activity LED is flashing during the selftest operation.
6. If any error occurs during the selftest, the tape drive will flash the Fault LED.
7. All LEDs are off after the selftest is performed successfully
8. If a tape cartridge is inserted, the tape cartridge will be loaded and the Ready LED will be lit.

4 Tape Drive Operation

4.1 Front LED Indicators

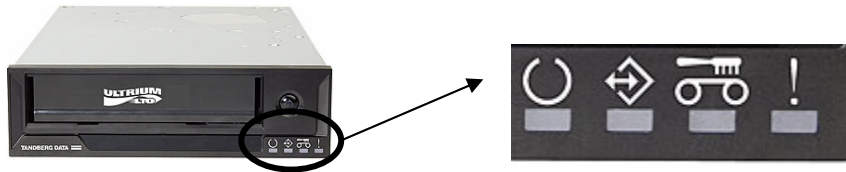


Figure 4.1 Status indicators (LEDs)





				
Drive State	READY LED (Green)	ACTIVITY LED (Green)	CLEAN LED (Amber)	FAULT LED (Amber)
LED-test. The LEDs are turned ON in sequence	ON	ON	ON	ON
Power-On Self-Test Starts in parallel with the LED-test .	Flashing in about 12 sec	After 12 sec: Flashing during cartridge load	OFF	OFF
Cartridge not loaded.	OFF	OFF	ON / OFF	OFF
Cartridge loaded, no activity	ON	OFF	ON / OFF	OFF
Cartridge loaded, activity	ON	Flashing	ON / OFF	OFF
Cleaning	OFF	Flashing	ON	OFF
Cartridge loading or unloading	OFF	Flashing	ON / OFF	OFF
Unrecoverable drive failure	ON / OFF	OFF	ON / OFF	Flashing
Over temperature	OFF	OFF	ON / OFF	ON
Media Error (wrong, write protected or harmed media)	OFF	Flashing	ON / OFF	Flashing

Table 4.1 Front LED behaviour during normal operation

See [Appendix A](#) for more information on LED operation

4.2 Tape Cartridge Operation

Use only certified quality cartridges for the Tandberg LTO HH Tape Drives. Do not use worn or audibly noisy cartridges. Cartridges which repeatedly require rewriting of large numbers of data-blocks per track should also be rejected.

4.2.1 Write Protecting the Cartridge

The LTO cartridge can be write-protected by operating the write protect switch.

The Tandberg LTO HH tape drive detects that the write-protect switch is set and then not allow any writing on the tape.

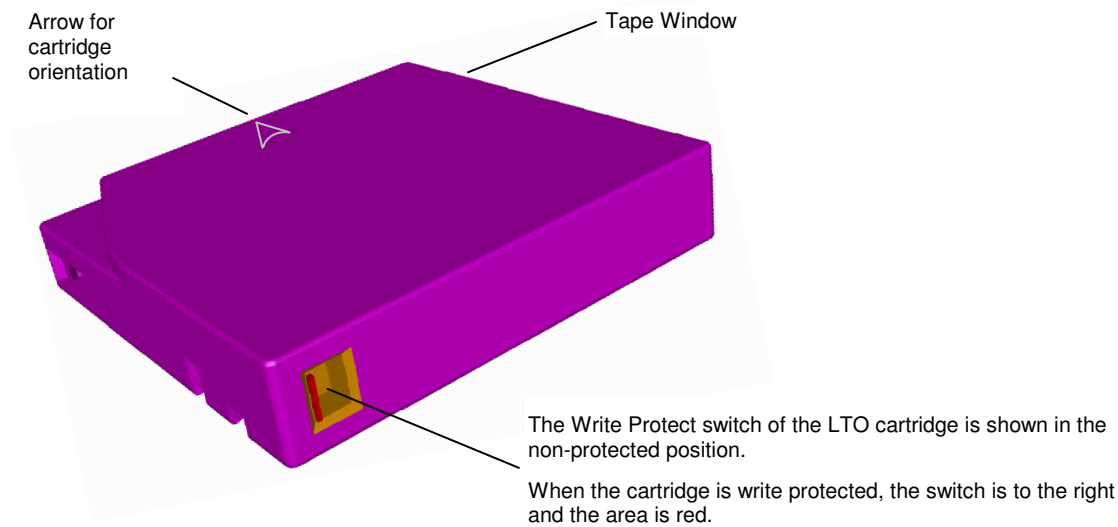


Figure 4.2 LTO cartridge write protect switch

4.2.2 Loading a Data Cartridge Into a Tandberg LTO HH

The cartridge must be inserted with the label facing up and the tape dust cover towards the LEDs. The drive has Semi-Soft Load: Slide the cartridge slowly into the Drive until it stops then let go. Then the cartridge is detected and a motor-driven load mechanism locks the cartridge automatically in the correct position.

In order not to damage the drive or the cartridge:

- DO NOT use extensive force
 - BE SURE to insert the cartridge in correct position
 - Be sure to insert the cartridge all the way in until a HARD stop
1. Ensure that the LTO cartridge is correctly oriented with the arrow on the cartridge pointing up and towards the tape drive (see *Figure 4.2* for tape orientation).
 2. Push the cartridge firmly into the tape drive until the point of hard stop and remove your hand. The tape drive starts loading.
 3. In case the drive will not hold the cartridge allow the cartridge to eject and settle completely. Wait for the Activity indicator (see [Section 4.1](#)) to turn off. Repeat the sequence from step 1.

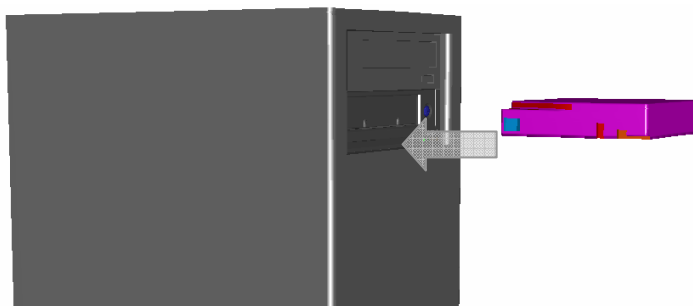


Figure 4.3 Cartridge insertion

4.2.3 Ejecting a Data Cartridge From a Tandberg LTO HH

The cartridge can be ejected either by pressing the eject button located on the drive's front panel, or by an Unload SCSI command. The drive automatically rewinds and ejects the cartridge (Soft Unload).

When removing the cartridge, wait until the soft-eject function has terminated its operation. Then pull the cartridge straight out.



Figure 4.4 Location of the eject button

4.3 Cleaning the Tape Drive

Prior to use, the LTO cleaning cartridge should be adapted to the operating environment for a time at least equal to the period it has been out of the operating environment and outside or above 10°C – 35°C (up to a maximum of 24 hours). Recommended operating temperature is 25°C/77°F or below (see tape drive specifications).

4.3.1 Recommended Cleaning Interval

The Clean LED steady ON indicates that a head cleaning operation is recommended (the drive is still fully operational with this LED steady ON) the LED is triggered after 100 hours of tape running time has elapsed, if the Media Management Algorithm has detected severely degraded write performance, or if a hard read/write error has occurred. The LED is not turned off by a power cycle. The LED is reset when cleaning has completed successfully.

Note: For the Tandberg LTO HH, cleaning is required when the cleaning LED (third from left) lights steady amber.

Always clean the head if large numbers of rewrite- or reread operations are performed. The head should also be immediately cleaned if hard Read or Write errors occur.

4.3.2 Cleaning Procedure

1. Load the cleaning cartridge into the LTO HH tape drive.
2. The cleaning process will begin automatically. This is indicated by the front LEDs on the product as follows:

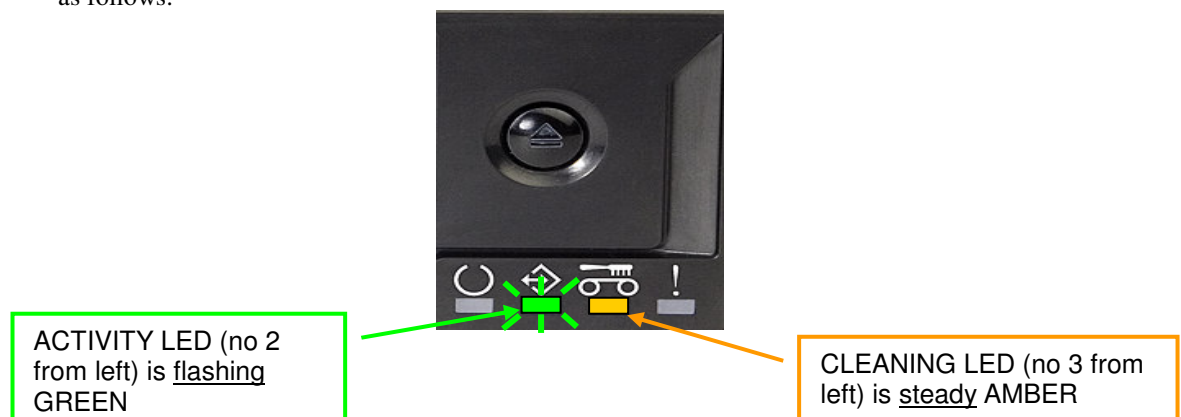


Figure 4.5 Activity and Cleaning LEDs

3. The cartridge will be ejected when cleaning has completed (about 3 minutes).
4. The CLEANING LED will be OFF if the cleaning was successful.
5. If the cleaning was NOT successful, the CLEANING LED will stay ON. See below

4.3.3 Cleaning Cartridge Replacement

The LTO Cleaning Cartridge can be used about 50 times in the Tandberg LTO HH tape drive.

Replace the LTO HH Cleaning Cartridge if it is ejected from the tape drive and the CLEANING LED is still constant AMBER.

4.4 Handling and Storing LTO Cartridges

To improve data reliability and LTO cartridge lifetime, it is important to handle and store the cartridges properly.

4.4.1 Handling LTO Cartridges

- Do not drop LTO cartridges
- Make sure the air around the tape drive and the LTO cartridge storage area is clean
- Prior to use, the LTO cartridge should be adapted to the operating environment for a time at least equal to the period it has been out of the operating environment outside and above 10°C – 35°C (up to a maximum of 24 hours). Recommended operating temperature is 25°C or below (see tape drive specifications).
- Replace worn or excessively noisy LTO cartridges

4.4.2 Storing LTO Cartridges

An LTO cartridge is best stored in its protective case.

4.4.3 Storage Condition

Store the LTO cartridge in a cool and dry environment. Avoid high temperatures. Recommended maximum temperature is 25°C/77°F and 50 % RH humidity.

Do not store the LTO cartridge near devices such as computer monitors, TV sets, or loudspeakers with strong magnetic fields (not exceeding 4000A/m).

5 Software Installation

This chapter contains information for installing tape drives in the following operating system environments:

- Windows 2000/2003/XP
- SCO Open Server
- SCO UnixWare
- Sun Solaris
- IBM AIX
- HP UX
- Linux

Please see www.tandbergdata.com SUPPORT, [Product], Compatibility for the most current backup application software compatibility information.

5.1 Windows 2000/2003/XP

5.1.1 Windows Tape Driver

The Tandberg LTO HH requires an additional tape driver that is available from the Tandberg website at www.tandbergdata.com.

5.1.2 Windows Tape Driver Installation

1. Right-click on *My Computer*.
2. Select *Manage*, you should see the tape drive under “Other devices” with a “?”.
3. Select the device, right click and *Properties*.
4. Select the appropriate driver location.
5. Follow the instructions on the screen.

5.1.3 Windows Embedded Backup Application

The Backup application is included in the Windows Operating System.

Before running the application, make sure the tape driver for your Tandberg LTO HH tape drive is properly installed. See Section 5.1.2.

To start the application:

1. Click on *START*.
2. Click on *Programs*.
3. Click on *Accessories*.
4. Click on *System tools*.
5. Select *Backup*.

5.2 SCO Open Server

5.2.1 Host Adapter

SCO OS includes a driver for most SCSI host adapters.

If you can not find the appropriate driver, please refer to the installation guide provided with the SCSI interface adapter.

To install the host adapter:

1. Login as root.
2. Type the following command: MKDEV TAPE.
3. Select Install a SCSI Tape Drive.
4. Enter the prefix of the SCSI host adapter that supports this device.
(Typing h gives you a list of the supported SCSI host adapter)
5. Which SCSI host adapter supports this device?
If only one SCSI host adapter is installed select 0. If two SCSI host adapters of the same type are installed, select 1
6. What is the target ID for this device? (2 is the Tandberg default SCSI-ID)
7. What is the LUN of this device? (Must be set to 0).
8. Update the SCSI Configuration?
Check first that the table on the screen is conformed to the Tape Drive configuration.
9. Press Return for the next three questions to use the default settings.
10. Select Tape Device Types. Choose 1 for Generic SCSI-1/SCSI-2 tape drive.

Note: The Kernel has to be rebuilt to reflect the new Hardware configuration, and a reboot is mandatory before you can use your LTO tape drive.

For any questions related to this operating system or its embedded Backup applet, please refer to the documentation provided on the SCO OS CD-ROM.

5.2.2 SCO Open Server System Commands

TAR, CPIO and DD allow simple backup, verify or restore operations to be performed.

Two different device drivers can be used:

- A Non Rewind device driver (used to perform append Backup)
- A Rewind device driver (used only to perform overwrite backup)

For a complete explanation on how to use the system commands, please refer to the SCO Open Server documentation, or the online help. (MAN command).

Tar command examples:

`tar cvf /dev/rStp0 /etc` will perform the backup of the /etc directory

`tar tvf /dev/rStp0` will read the data on the tape

`tar xvf /dev/rStp0` will restore the data from the tape to the current directory tree

5.2.3 SCO Open Server Backup Manager

SCO Open Server Graphic Interface

1. Click on System Administration.
2. Double-click on Backup Manager.
3. Follow the instructions on the screen

SCO Open Server Console

1. Login as Root.
2. Type SCOADMIN.
3. Select Backup Manager.

5.3 SCO UnixWare

5.3.1 Host Adapter

SCO UnixWare includes a driver for most SCSI host adapters.

If the appropriate driver cannot be found, please refer to the installation guide provided with the SCSI host adapter.

5.3.2 Installation

1. Install the Tandberg LTO HH tape drive.
2. Turn on the PC.
3. During the boot process, SCO UnixWare automatically detects the LTO HH and installs the correct tape driver.

Note: For any questions related to this operating system or its embedded Backup applet, please refer to the documentation provided on the SCO CD-ROM.

5.3.3 SCO UnixWare System Command

TAR, CPIO and DD allow simple Backup, Verify or Restore operations to be performed.

Two different device drivers can be used:

- A *Non Rewind* device driver (used to perform append backup)
- A *Rewind* device driver (used only to perform overwrite backup)

For a complete explanation on how to use the system commands, please refer to the SCO UnixWare documentation, or the online help. (MAN command).

Tar command examples:

`tar cvf /dev/rmt/c0s0 /etc` performs the backup of the /etc directory

`tar tvf /dev/rmt/c0s0` reads the data on the tape

`tar xvf /dev/rmt/c0s0` restores the data from the tape to the current directory tree

5.4 Sun Solaris

5.4.1 Tape Drive Installation

1. Install the Tandberg LTO HH Tape Drive.
2. Turn on the SUN workstation or server.
3. Use `rm -f /dev/rmt/*` to remove any reference to old tape device, and then use `devfsadm -c tape`.

This reconfigures the `/dev/rmt` directory for the LTO HH to work properly on the machine.

For improved performance using the Tandberg LTO HH, a specific system file can be modified:

`/kernel/drv/st.conf`

ST.CONF File entries for Tandberg LTO HH:

```
"TANDBERGTS400", "Tandberg LTO-2 HH LTO", "TANDBERG_TS400";  
TANDBERGTS200", "Tandberg LTO-1 HH LTO", "TANDBERG_TS200";*  
TANDBERG_TS400 =1,0x36,0,0x9639,3,0x00,0x40,0x42,2;
```

* Will be "TANDBERG_TS400" until TBA

5.4.2 Sun System Command

TAR, CPIO and DD allow simple Backup, Verify or Restore operations to be performed.

Two different device drivers can be used:

- A *Non Rewind* device driver (used to perform append backup)
- A *Rewind* device driver (used only to perform overwrite backup)

Tar command examples:

`tar cvf /dev/rmt/0cb /etc` performs the backup of the `/etc` directory

`tar tvf /dev/rmt/0cb` reads the data on the tape

`tar xvf /dev/rmt/0cb` restores the data from the tape to the current directory tree.

For a complete explanation on how to use the system commands, please refer to the Sun documentation, or the online help. (MAN command).

5.5 IBM AIX

5.5.1 Tape Drive Installation

To install any of the Tandberg LTO HH tape drives on IBM AIX, the *smit* utility must be used.

1. Be sure the SCSI-ID of the tape drive is not used in the SCSI Sub-System.
2. Install the LTO HH tape drive.
3. Login as *root*.
4. Run *smit* devices.
5. Select Tape Drive.
6. Follow the instructions on the screen.

For improved performance on LTO HH, the default block size should be set to 0 and the density to default LTO type :

1. Run *smit* devices.
2. Select Change/Show characteristics of a tape drive.
3. Select the tape driver you want to modify.
4. Set the BLOCK size to 0
5. You can set the density codes that the LTO HH support by enter the value of 66 & 64 (0x42 for LTO2 and 0x40 for LTO1) in the field DENSITY setting #1 & #2 respectively.

5.5.2 IBM AIX System Command

TAR, CPIO and DD allow simple Backup, Verify or Restore operations to be performed.

Two different device drivers can be used:

- A *Non Rewind* device driver (used to perform append backup)
- A *Rewind* device driver (used only to perform overwrite backup)

Please refer to the IBM AIX documentation for more information.

Tar command examples:

tar cvf /dev/rmt0 /etc performs the backup of the /etc directory

tar tvf /dev/rmt0 reads the data on the tape

tar xvf /dev/rmt0 restores the data from the tape to the current directory tree

5.5.3 IBM AIX Storage Manager

This application is part of the operating system. Install as follows:

1. Open the System Administrator window.

2. Double-click on *Storage Manager*.
The list of available tape device(s) appears on the screen.
3. Follow the instructions on the screen to continue

Note:

For any questions related to this application or its installation, please refer to the IBM online documentation

5.6 HP/UX

5.6.1 Tape Drive Installation

To install the Tandberg LTO HH tape drives, use the SAM utility.

1. Login as *root*.
2. Run *SAM*.
3. Select Peripheral Devices.
4. Select Action/Add.

The Tandberg LTO HH is automatically detected and the necessary drivers installed.

5.6.2 HP/UX System Command

TAR, CPIO and DD allow simple Backup, Verify or Restore operations to be performed.

Two different device drivers can be used:

- A *Non Rewind* device driver (used to perform append backup)
- A *Rewind* device driver (used only to perform overwrite backup)

Tar command examples:

tar cvf /dev/rmt0 /etc performs the backup of the /etc directory

tar tvf /dev/rmt0 reads the data on the tape

tar xvf /dev/rmt0 restores the data from the tape to the current directory tree

For a complete explanation on how to use the system commands, please refer to the HP/UX documentation, or the online help. (MAN command).

5.7 Linux

5.7.1 SCSI Host Adapter

Linux contains a driver for most SCSI host adapters.

If the driver cannot be found, please refer to the documentation provided with the SCSI host adapter.

5.7.2 Tape Drive Installation

1. Install the Tandberg LTO HH Tape Drive.
2. Turn on the PC.
3. During the boot process, Linux automatically detects the LTO HH and installs the correct tape driver.

For improved performance using the Tandberg LTO HH, a specific system file can be modified:

/etc/stinit.def

stinit.def File entries for Tandberg LTO HH:

```
manufacturer="TANDBERG" model = "TS400" {
scsi2logical=1
can-bsr=1
auto-lock=0
two-fms=0
drive-buffering=1
buffer-writes
read-ahead=1
async-writes=1
can-partitions=1
fast-mteom=1
mode1 blocksize=0 density=0x42 compression=1 # 400 GB, native
mode2 blocksize=0 density=0x42 compression=0 # 200 GB, LTO
}
```

Note:

For any questions related to this operating system or its embedded backup applet, please refer to the documentation provided on the Linux CD-ROM.

5.7.3 Linux System Command

TAR, CPIO and DD allow simple Backup, Verify or Restore operations to be performed.

Two different device drivers can be used:

- A *Non Rewind* device driver (used to perform append backup)
- A *Rewind* device driver (used only to perform overwrite backup)

Tar command examples:

tar cvf /dev/st0 /etc performs the backup of the */etc* directory

tar tvf /dev/st0 reads the data on the tape

tar xvf /dev/st0 restores the data from the tape to the current directory tree

For a complete explanation on how to use the system commands, please refer to the Linux documentation, or the online help. (MAN command).

5.8 Tape Drive Utilities

On www.tandbergdata.com under SUPPORT, [Product], Software, the following software tool can be found:

5.8.1 FlashIt – Firmware Upgrade Utility

This utility is used for updating the LTO HH firmware.

FlashIt is a simple program that can be used to upgrade the microcode in the Tandberg Data range of tape drives and in Tandberg Data Autoloaders and Libraries. FlashIt communicates with the devices through their SCSI interface.

FlashIt automatically finds all supported SCSI devices in your system (not disks). FlashIt also guides you in locating microcode files and gives you an indication of which microcode files can be used to upgrade the selected device.

FlashIt comes in separate versions for DOS, Windows 95/98/ME and Windows NT/2000/2003/XP.

Note:

For more information, please see the User Guide available on the www.tandbergdata.com select SUPPORT, [Product], Software

5.8.2 TDKit – Tool for Testing and Downloading Firmware

TDKit is a program that can be used to inspect and change some of the tape drives parameters and to execute some simple tape operations. It also gives the operator the possibility to perform a few tests that can be useful to check the reliability of the SCSI connection, the tape drive and the media. Finally it can be used to upgrade the drive fw and perform a data dump for deep analyses.

TDKit can be downloaded from www.tandbergdata.com – select SUPPORT, [Product], Software

6 Troubleshooting

In case of problems with operation of your Tandberg LTO HH tape drive and before contacting the Customer Services Group, please be sure to check the following:

6.1 Hardware Checking

1. Check that the system recognizes the tape drive during the boot process.
2. Check that the SCSI host adapter recognizes the tape drive during its initialization.
3. Check the tape drive Front Panel LED status.
4. Check that the SCSI-ID of the drive is not conflicting on the SCSI-bus.
5. Check that the power cable is inserted correctly.
6. Check that the SCSI cable connections including termination are made correctly.

6.2 Software Checking

1. Check that the operating system does not report a problem during the boot.
2. Check that the driver for the SCSI host adapter is present and loaded properly.
3. Check that the correct Tape Device Driver has been installed properly - if applicable.
4. Check that the Backup software does not report any error messages when loading.
5. If any problem occurs, reinstall the Backup Application Software and check that the LTO-2 HH is recognized.

6.3 Verifying Recent Changes

If the Tandberg LTO HH has been installed previously and operating correctly but is now incurring a problem, verify any recent changes to the system to ensure that these changes are not causing the problem. Try the following:

1. If the system configuration has changed:
Remove the change to see if it affected the tape drive.
2. If an operating system corrective patch has been installed:
Remove it to see if it affected the tape drive.
3. If a SCSI device has been added:
Check for SCSI-ID conflicts.
4. If a SCSI device has been added:
Check if the SCSI termination has been properly set.

6.4 Standalone Diagnostics

The main objective for the Standalone Diagnostics test is to test the complete drive as comprehensive and fast as possible without any drive configuration or host support. The tool can also be used to verify tapes.

6.4.1 Starting the Test

A Standalone Diagnostic test requires a tape that is not write-protected. The media type can be any media type that supports a tape format that can be written by the drive.

CAUTION: *Since the test involves write operations, the existing tape contents will be destroyed!*

1. Make sure that no cartridge is loaded.
No cartridge should be loaded at this stage. If a cartridge is loaded it can be ejected by clicking the Eject Button.
2. Enter Service Mode by keeping the Eject Button pressed for at least 6 seconds.
The Ready LED (on the left) starts flashing fast (indicating the drive is in Service Mode and that Service entry number 1 is active).
3. Insert the tape cartridge into the drive within 15 seconds.

The drive loads the cartridge and the Ready LED starts flashing indicating that Standalone Diagnostics has started. The eject button has now returned to normal mode. During the Standalone Diagnostics test, it is possible to abort the test and eject the cartridge by clicking the eject button. The drive indicates the detection of the abort request by flashing both the Ready and Activity LEDs. Depending on at which stage the test is aborted, it may take a while before the drive starts the eject operation. When the cartridge has been ejected, all LEDs are turned off (the Cleaning LED may however be on).

The Ready LED will continue flashing during the complete test. The Activity LED will be flashing when the test performs tape motion.

If no cartridge has been inserted after 15 seconds, the LEDs revert back to their initial state and the Eject Button must be pressed for 6 seconds again to get back to Service Mode.

6.4.2 Test Sequence

The Tandberg LTO HH Standalone Diagnostics test will perform the following operations:

Collect Information. Reads and stores drive and medium information:

- Firmware and Drive ID
- Tape type and format
- Cartridge serial number
- Error History Log and Log page 0x33 from EEPROM
- Run-time counters from EEPROM

Mainboard Test. Tests the mainboard hardware.

Cartridge Manipulation Test. The Cartridge Manipulation Test performs the same mechanical movement operations as those performed during Cartridge Load and Eject.

Read/Write Test. This test involves actual reading and writing on the tape medium. A write pass and a read pass are executed.

When the test has completed without errors the tape cartridge is ejected. No LEDs will be lit (the Cleaning LED may however be on).

6.4.3 Failure Indication

When a failure has been detected the tape is not ejected and the Failure LED will be flashing.

Detailed information can be retrieved by the 'Receive Diagnostic Results' SCSI command.

If a write protected, unsupported, or damaged tape cartridge is inserted in order to start the Standalone Diagnostics test, it will be ejected by the drive and the Failure and Activity LEDs will be flashing while the Ready LED is off. The two flashing LEDs can be turned off by clicking the Eject Button.

6.5 Media Management Reporting 1

Media Management (MM) is a feature embedded in the Tandberg LTO HH tape drive's firmware that monitors the read and write performance of the tape drive and media. Write performance information is written on the media header every time the media is rewound, and before the media is unloaded.

6.5.1 Cleaning is required

If the write performance is below a factory set re-write threshold, the Tandberg LTO HH reports that cleaning is required.

Tandberg LTO HH reports that cleaning is required by setting the Clean LED to steady AMBER, and sending information to the backup application software using the SCSI Tape Alert reporting standard.

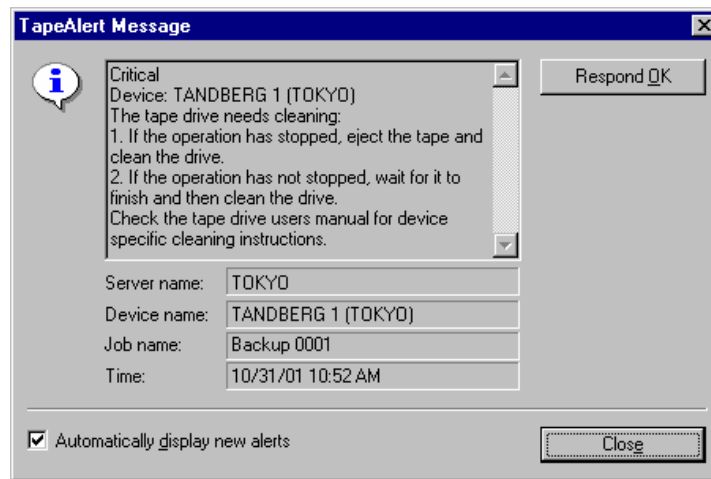


Figure 6.1 Backup Exec reporting that the tape drive needs cleaning

```
TAPE    ***TapeAlert*** The following information is for Device[0]:

TAPE    E6918 The tape drive needs cleaning:
1. If the operation has stopped eject the tape and clean the drive.
2. If the operation has not stopped wait for it to finish and clean the
drive.
Check user's manual for cleaning instructions.
```

Figure 6.2 ARCserve reporting that the tape drive needs cleaning

If the Tandberg LTO HH works normal after cleaning, both media and tape drive are good.

6.5.2 Degraded Media

If the write performance is still below the re-write threshold after cleaning, MM reports via the Clean

LED (set to steady AMBER) and the backup application software that the media is degraded.

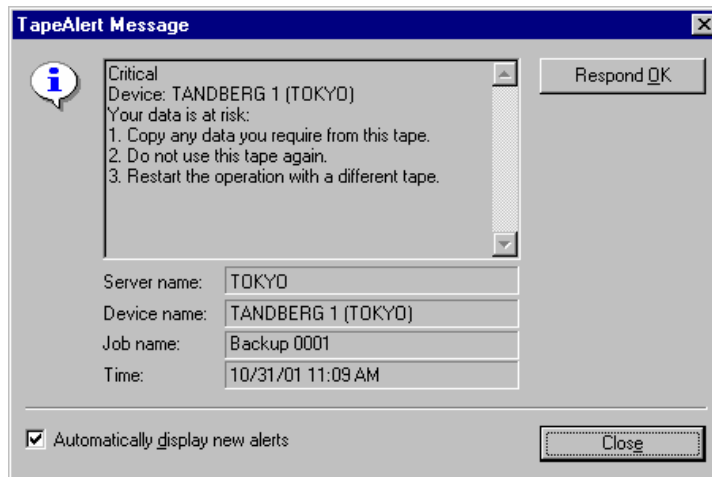


Figure 6.3 Backup Exec reporting that the media is degraded

The degraded media warning is a warning that the cartridge is less safe, and if it continues to be used, it may become worn to the point where drive cannot write or read successfully using this cartridge.

```

TAPE ***TapeAlert*** The following information is for Device[0]:

TAPE E6913 Your data on tape[10/26/01 1:25 PM] serial number[303145]
is at risk.
1. Copy any data require from this tape. Do not use this tape again.
2. Restart operation with a different tape.
  
```

Figure 6.4 ARCserve reporting that the media is degraded

6.6 Problem Situations

6.6.1 Dead on Arrival

1. Check LED activity at power up.
All four LEDs flash for two seconds at power up and the Ready LED flashes for several seconds while the power-on self test is running.
2. Make sure that the power supply used is working:
Measure with an external voltmeter or use a verified supply.
3. Perform “drive dead test” when supply is verified.
Push the eject button for at least 6 seconds to enter the “drive dead test”. The Activity LED should keep flashing for approximately 15 seconds.

If the drive still looks dead try to remove all cable except power and redo “drive dead test”, a defective cable or SCSI host bus adapter may leave the drive in a reset condition.

6.6.2 Damaged Front Bezel

There are no electrical parts or cables in the front bezel.

1. Eject and remove any cartridge in the drive before replacing the front bezel.

2. Remove the damaged front bezel.
Use a small flat screwdriver or your fingernails to lift the small plastic “ears” on each side of the drive.
3. Install the new bezel.
Push it gently onto the front of the drive until the “ears” snap into place on each side.

6.6.3 Drive Not Detected by the Operating System (OS)

1. Check LED activity at Power Up
All four LEDs flash for two seconds at power up and the Ready LED flashes for several seconds while the power-on self test is running.
2. Check the SCSI-ID
Each device on the SCSI bus needs a unique SCSI-ID. The SCSI-ID is set with jumpers on the backside of the drive. See label on drive, the installation guide supplied with the tape drive, or on the web for instructions.
3. Check SCSI termination
The SCSI bus should be terminated at the end of the cable; a defective terminator may leave the drive in a reset condition.

6.6.4 Will Not Insert/Hold Media /Media is Not Recognized

1. Check cartridge type.
Tandberg LTO-3 HH will only accept LTO-1, LTO-2 or LTO-3 type data or cleaning cartridges.
Tandberg LTO-2 HH will only accept LTO-1 or LTO-2 type data or cleaning cartridges.
Tandberg LTO-1 HH will only accept LTO-1 or cleaning cartridges.
If a wrong type of cartridge is inserted, it can be mechanically prevented from being inserted or electrically rejected after insertion.
2. Check media orientation.
The arrow on the cartridge must point into the tape drive facing up when the tape drive is mounted horizontally with the LEDs on the right.
Media can be inserted only the “correct way”; there are mechanical blockings if the media is insert wrong.
3. Try using a new cartridge.
If it loads correctly, check the failing cartridge for damage.
4. Check failing media for pin damage (buckling pin).
Hold the cartridge in your hand with the Write Protect Switch to your left and orientation arrow pointing from you. On the right side all the way in front is a small door that can be opened by sliding a door against you. Inside the cartridge you should see a metal pin, the pin shall be parallel with the cartridge front and is hold in place by to metal grippers at each end (top and bottom of the cartridge). The media should be attached to this pin, and you see only the top and bottom part of the pin.

If the pin is missing, loose or damaged the tape will be damaged and rejected from the drive.

6.6.5 Noisy Tape Drive

There are no fans in the Tandberg LTO HH tape drive and the noise should be very low in idle mode. When the tape moves the noise can come from the media itself. The drive will give a steady sound when streaming. The sound is “intermittent” if the host is not delivering data at the data rate of the drive.

1. Check if the noise comes from the cartridge.
Insert new media – first check this media for any damage.

2. Check that the Tandberg LTO HH is mounted correctly.
If the Tandberg LTO HH is mounted incorrectly, it can produce noise when the tape moves.

6.6.6 Cartridge is Stuck Inside the Drive

1. Try to eject the cartridge by pushing the eject button
2. Do a drive reset using the Service mode.
Service mode is entered by keeping the eject button pressed for at least six seconds. The Activity LED starts flashing.
3. To reset the drive, push the eject button once more to make the Activity LED flash. While this LED is flashing, double-click the eject button. This should make the drive do a reset.
4. If the button is not pushed for 15 seconds, the eject button reverts back to its original cartridge eject function.
5. Power cycle the drive (switch power on/off, if possible).

6.6.7 Fault LED Flashes Amber and the Activity LED is Off

The tape drive reports that it has a failure.

1. Do a Drive reset using the Service mode.
Service mode is entered by keeping the eject button pressed for at least six seconds. The Ready LED will start flashing.

To reset the drive, push the eject button once more to make the Activity LED flash. While this LED is flashing, double-click the eject button. This should make the drive do a reset.

If the button is not pushed for 15 seconds, the eject button reverts back to its original cartridge eject function.

2. Power cycle the drive (switch power on/off, if possible).

6.6.8 Fault LED Is Flashing Amber and the Activity LED Is Flashing

The drive signals Media Error.

To eject the cartridge, press the Eject button

1. Check if the media is correct.
2. Check the write protection switch position.
3. Check if the media is damaged (see also Section 6.6.4).
4. Check if an expired cleaning cartridge was used (Clean LED is On)

6.6.9 Cleaning LED Is ON

The Cleaning LED will go ON 100 hours after the last cleaning operation or after an unrecoverable read or write error. Unrecoverable read or write errors may have been caused by debris on the read/write head. If the Cleaning LED was switched ON by the 100 hours function, the drive will function as normal with the Cleaning LED is on. Cleaning is always recommended when the Cleaning LED is ON.

1. Run cleaning operation with cleaning tape.
The Cleaning LED indicates that the drive needs cleaning due to elapse of 100 hours since last cleaning or a hard Write /Read error occurred that may be caused by debris on the head(s).
2. If the Cleaning LED is still On after running the cleaning operation, check for expired cleaning tape.
A cleaning tape can be used 50 times. If an expired cleaning tape is used, the drive ejects the cleaning tape and the Cleaning LED stays lit.

6.6.10 Incorrect Data Compression

1. Check if data is already compressed
Data may have been compressed by software in the host computer.

In some cases data will actually expand when subjected to the compression. This may for instance be the case when sending already compressed data to the drive and the compression option is enabled. In this case the drive automatically turns compression on and off to optimize the data storage.

Important: Tandberg LTO HH has compression ON by default. The compression can be turned OFF by using the SCSI Mode Select command.

2. Turn OFF any software compression in use.
The compression is done in the Tandberg 200LTO, LTO-2 HH's hardware. Therefore any other compression software in the host or on the host bus adapter should be turned off.

The data is compressed using the SLDC (Streaming Lossless Data Compression) algorithm that is based on ALDC (Adaptive Lossless Data Compression). The SLDC format is defined in the ECMA-321 standard. Two enhancements are introduced:

- Uses two methods to reduce expansion of uncompressible data.
- Uses embedded code words.

6.6.11 Slow Performance

1. Check that the software driver used for the Tandberg LTO HH is the latest version.
Running without or with wrong software driver can cause the drive to run with low performance due to wrong block size and buffer usage.
2. Clean the tape drive.
3. Perform a Drive Diagnostics test ([see Section 6.4](#)).

6.6.12 Intermittent Failures

If the drive fails intermittently:

1. Clean the tape drive.
2. Check the SCSI termination on the SCSI Bus.
3. Check the operating system logs for any errors.

If the problem occurs in the middle of an operation:

1. Try with a different data cartridge.
2. If the error occurs when the software scans for the files to be backed up, please operate a SCANDISK (or similar) operation to check the state of the File Systems(s) and hard disk.

If the error occurs always on the same file or directory:

1. Try to remove the file or directory from the backup operation to see if that corrects the problem.
2. Try with a different data cartridge before the drive is sent for service.

6.6.13 Tape Removal Procedure

Available on request; good technical knowledge is needed.

7 Glossary of Terms

Active Termination	Enhanced SCSI termination that provides better stability and noise immunity of the electrical signals on the SCSI-bus lines.
ALDC	Adaptive Lossless Data Compression. A hardware data compression method.
ASPI	Advanced SCSI Programming Interface. Standard SCSI software that acts as a liaison between host adapters and SCSI device drivers. ASPI enables host adapters and device drivers to share a single SCSI hardware interface.
Auto sensing	220LTO, LTO-2 HH feature that allow detection of the best transfer rate to use for optimizing performance on the SCSI-bus.
Data Compression	There are two ways to compress data on tape. Through the software data compression or using hardware data compression as on the Tandberg LTO HH
Device Driver	A software program that enables a computer to communicate with peripheral devices such as a hard disk or tape drives. Each type of device needs a different device driver. Device drivers are stored on a computer's hard disk and are typically loaded into memory at boot time.
EEPROM	Electrically Erasable Programmable Read Only. An integrated circuit typically used to store configuration information.
GUI	Graphical User Interface. Software which interacts with the user.
ID	See SCSI-ID.
LVD	Low Voltage Differential. LVD provides better stability and noise immunity of the electrical signals on the SCSI-bus lines. LVD also allows longer SCSI Bus length.
Overwrite	A method of recording over data previously written on tape without performing a erase operation before.
PNP	Plug and Play. A hardware and software mechanism that provides an automatic way for the system to self-configure system resources such as I/O ports, IRQ, and DMA channels between PNP cards and other devices in the system.
RWW	Read While Write. All Tandberg tape drives automatically and internally read the data just being written to the tape to avoid writing to bad block.

SCAM	SCSI Configured AutoMagically. A SCSI protocol that assigns automatically SCSI-IDs to SCAM capable devices such as the Tandberg LTO HH tape drives when you boot the system.
SCSI	Small Computer Signaling Interface. The Tandberg LTO HH utilizes the SCSI Ultra320 interface which allows for a transfer rate of up to 320 MB/s on the bus.
SCSI-ID	A unique identifier assigned to SCSI devices that enables them to communicate with a computer when they are attached to a host adapter via the SCSI-bus. Each SCSI host adapter board has eight available SCSI-IDs with numbers 0 through 7 (or 0 through 15 for Wide SCSI adapters). Usually the host adapter itself is assigned SCSI-ID 7.
SLDC™	Streaming Lossless Data Compression. The hardware data compression method specified as the standard for the two Ultrium tape formats and thus used with the Tandberg 200LTO, LTO-2 HH tape drives.
Ultra/Ultra2	16-bit WIDE SCSI/LVD interface used with SLR7, 24, 40, 50, 60, 75, 100 and 140 tape drives.

8 App. A. LED-Indicator Behavior

8.1 LED-behavior During Normal Operation

Drive State ¹	READY LED (Green left)	ACTIVITY LED (Green)	CLEAN LED (Amber)	FAULT LED (Amber right)
LED-test. The LEDs are turned ON in sequence	ON	ON	ON	ON
Power-On Self-Test Starts in parallel with the LED-test .	Flashing in about 12 sec	After 12 sec: Flashing during cartridge load	OFF	OFF
LED-test. The LEDs are turned ON one-by-one.	ON	ON	ON	ON
Power-On Self-Test starts in parallel with the LED-test ² .				
Diagnostic Activity / POST ⁴	Flashing	OFF	OFF	OFF
Aborting Diagnostic Test	Flashing	ON / OFF / Flashing	ON ³ / OFF	Flashing
Cartridge not loaded.	OFF	OFF	ON ³ / OFF	OFF
Cartridge loaded, no activity	ON	OFF	ON ³ / OFF	OFF
Cartridge loaded, activity	ON	Flashing	ON ³ / OFF	OFF
Cleaning	OFF	Flashing	ON	OFF
Cartridge loading or unloading	OFF	Flashing	ON ³ / OFF	OFF
Unrecoverable drive failure	ON / OFF	OFF	ON ³ / OFF	Flashing ⁵
Firmware download in progress	Flashing	OFF	ON ³ / OFF	OFF
Firmware update in progress	Flashing	Flashing	ON ³ / OFF	OFF
Firmware download failure ⁶	Flashing	Flashing	ON ³ / OFF	Flashing ⁵
Over temperature ⁷	OFF	OFF	ON ³ / OFF	ON
Aborting Diagnostic Test	Flashing	ON / OFF	ON ³ / OFF	Flashing
Media Error (wrong, write protected or harmed media)	OFF	Flashing	ON ³ / OFF	Flashing

NOTE 1:

Some of the states are difficult to see due to short duration.

NOTE 2:

LEDs are also used to indicate fatal errors at an early power-up stage. This is accomplished by turning the LEDs ON one-by-one:

- The *Ready* LED as early as possible (after CPU-initialization).
- The *Activity* LED before initialization of serial communication interface (DACI).
- The *Clean* LED after PROM checksum test.
- The *Fault* LED after the CPU and SRAM Tests

After all LEDs are lit there is no controlled stop, and if the next LED-phase (flashing *Ready* LED) never appears, the system has crashed somewhere in the remaining part of the POST/PUI Part1. All LEDs are steady on for approximately 2 seconds.

NOTE 3:

- The *Clean* LED steady ON indicates that a head cleaning operation is recommended (the Drive is still fully operational with this LED steady ON) the LED is triggered after 100 hours of tape running time has elapsed, if the Media Management Algorithm has detected severely degraded write performance, or if a hard read/write error has occurred. The LED is not turned off by a power cycle. The LED is reset when cleaning has completed successfully. The *Clean* LED is also turned on during Head Brush operation (no sticky).

NOTE 4:

- When a diagnostic activity leads to media operations (load/eject, read/write etc.) the LED behavior changes to a behaviour that corresponds to this kind of operation in a normal activity, but with *Ready* LED still flashing.

NOTE 5:

- The *Fault* LED will flash to indicate an unrecoverable error. An unrecoverable error is an error condition that results in the drive not being able to function unless initiator, operator, or service intervention is applied. An unrecoverable drive failure is usually the result of a hardware error condition. One of the following actions will be needed to clear the flashing *Fault* LED:
 - Hard SCSI Reset
 - Cartridge Emergency Eject
 - Power Cycle
 - Retry Firmware Download

An unrecoverable cartridge (media) failure is usually the result of a defective cartridge, media, or cartridge tape and will require the drive to eject the cartridge (if possible) to clear the flashing LED.

NOTE 6:

- Firmware download failed and the drive is not functional. The drive boot code is in control and the firmware download should be retried. The drive can be identified via an INQUIRY command and is thereby bootable while in this state.

NOTE 7:

- The *Fault* LED will be on solid to indicate an over temperature (tape temperature > 47°C). If a tape is present it will be ejected. The LED will remain on until one of the following conditions are met:
 - The drive temperature goes below the preset maximum, and a new data or leaning cartridge is inserted
 - The drive temperature goes below the preset maximum, and the tape drive is power cycled.